

## PATENT

**AMENDMENTS TO THE CLAIMS**

**Please amend the claims as follows:**

1. (Currently Amended) An implantable cardiac stimulation device for implantation in a body comprising:

a metabolic demand sensor that is capable of sensing a parameter indicative of the body's metabolic demand;

an activity sensor that is capable of sensing a parameter indicative of physical activity of the body;

circuitry connected to the respective sensors and that is operative to process signals from the respective sensors to detect a ~~potential~~ sleep apnea condition; and

one or more pulse generators that are capable of generating cardiac pacing pulses, wherein the circuitry is responsive to ~~detection of a potential~~ the detected sleep apnea condition to control the one or more pulse generators to generate cardiac pulses with a timing that tends to terminate the detected sleep apnea condition according to a sleep apnea prevention pacing mode; and

a neurostimulator coupled to respiratory muscles of the body's upper airways or diaphragm, the neurostimulator being adapted to generate neurostimulation pulses for terminating the detected sleep apnea condition if the generated cardiac pacing pulses fail to terminate the detected sleep apnea condition.

2. (Currently Amended) An implantable cardiac stimulation device according to Claim 1 wherein the circuitry comprises a controller coupled to the one or more pulse generators and to the metabolic demand and activity sensors, the controller including an executable control logic that detects a sleep condition and controls the one or more pulse generators to generate pacing pulses with a timing based on a ~~the on the~~ comparative analysis of the metabolic demand-indicative parameter and the physical activity-indicative parameter performed by the controller that is capable of ~~[[preventing a]]~~ terminating the detected sleep apnea condition.

## PATENT

3. (Currently Amended) An implantable cardiac stimulation device according to Claim 1 wherein the circuitry comprises a controller coupled to the one or more pulse generators and to the metabolic demand and activity sensors, the controller including an executable control logic that detects a sleep condition upon a determination that the metabolic demand-indicative parameter and the physical activity-indicative parameter are at low resting levels and detects ~~[[a]] the detected~~ sleep apnea condition upon a determination that the metabolic demand-indicative parameter diverges to a lower level relative to the physical activity-indicative parameter.

4. (Original) An implantable cardiac stimulation device according to Claim 1 wherein the circuitry comprises a controller coupled to the one or more pulse generators and to the metabolic demand and activity sensors, the controller including an executable control logic that detects a sleep apnea condition and controls the one or more pulse generators with a timing based on one or more of the metabolic demand-indicative parameter and the physical activity-indicative parameter that is capable of treating the detected sleep apnea condition.

5. (Currently Amended) An implantable cardiac stimulation device according to Claim 1 wherein the circuitry comprises a controller coupled to the one or more pulse generators and to the metabolic demand and activity sensors, the controller including an executable control logic that distinguishes between a sleeping condition and a waking condition of a patient, and controls the one or more pulse generators to generate pacing pulses with a timing based on a the-on-the comparative analysis of the metabolic demand-indicative parameter and the physical activity-indicative parameter performed by the controller that is capable of ~~[[preventing]] terminating the detected~~ sleep apnea condition.

## PATENT

6. (Currently Amended) An implantable cardiac stimulation device according to Claim 1 wherein the circuitry comprises a controller coupled to the one or more pulse generators and to the metabolic demand and activity sensors, the controller including an executable control logic that controls the one or more pulse generators to pace at a rate selected from among at least a sleeping rate, a resting rate, and an exercising rate, the executable control logic being capable of distinguishing between a sleeping condition and a waking condition based on a comparative analysis of the metabolic demand-indicative parameter and the physical activity-indicative parameter performed by the controller, and controlling the one or more pulse generators to pace at a rate greater than the resting rate in response to detection of a sleeping condition.

7-8. (Cancelled)

9. (Original) An Implantable cardiac stimulation device according to Claim 1 further comprising:

a transthoracic impedance sensor that is capable of sensing a respiration parameter and functioning as the metabolic demand sensor; and

an accelerometer that is capable of sensing a physical activity parameter and functioning as the activity sensor.

10. (Original) An implantable cardiac stimulation device according to Claim 1 further comprising:

a physiological sensor that measures blood oxygen concentration and wherein the circuitry activates sleep apnea preventive pacing when blood oxygen concentration is depressed during sleep.

## PATENT

11. (Original) An implantable cardiac stimulation device according to Claim 1 further comprising:

a physiological sensor that measures blood carbon dioxide concentration and wherein the circuitry activates sleep apnea preventive pacing when blood carbon dioxide concentration is elevated during sleep.

12. (Currently Amended) An implantable cardiac stimulation device for implantation in a body comprising:

a metabolic demand sensor that is capable of sensing a parameter indicative of the body's metabolic demand;

an activity sensor that is capable of sensing a parameter indicative of physical activity of the body;

one or more pulse generators that are capable of generating cardiac pacing pulses with a timing based on ~~a comparative analysis of the metabolic demand-indicative parameter and the physical activity-indicative parameter~~, the timed cardiac pacing pulses for treating a first level of sleep apnea; and

a neurostimulator that is capable of coupling to respiratory muscles of the body's upper airways or diaphragm and generating neurostimulation pulses treating a second level of sleep apnea if the generation of the cardiac pacing pulses fails to terminate the first level of sleep apnea.

13. (Currently Amended) An implantable cardiac stimulation device according to Claim 12 further comprising:

a controller coupled to the one or more pulse generators, the metabolic demand and activity sensors, and the neurostimulator, the controller including an executable control logic that detects a sleep condition and a sleep apnea condition based on ~~one or more of the metabolic demand-indicative parameter and the physical activity-indicative parameter.~~

## PATENT

14. (Currently Amended) An implantable cardiac stimulation device according to Claim 12 further comprising:

a controller coupled to the one or more pulse generators, the metabolic demand and activity sensors, and the neurostimulator, the controller including an executable control logic that distinguishes between a sleeping condition, a waking condition, and a sleep apnea condition of a patient, and controls the one or more pulse generators to generate pacing pulses with a timing based on a the-on-the comparative analysis of the metabolic demand-indicative parameter and the physical activity-indicative parameter performed by the controller that is capable of treating the sleep apnea condition.

15. (Currently Amended) An implantable cardiac stimulation device according to Claim 12 further comprising:

a controller coupled to the one or more pulse generators, the metabolic demand and activity sensors, and the neurostimulator, the controller including an executable control logic that controls the one or more pulse generators to pace at a rate selected from among at least a sleeping rate, a resting rate, and an exercising rate, the executable control logic being capable of distinguishing between a sleeping condition, a waking condition, and a sleep apnea condition based on comparative analysis of the metabolic demand-indicative parameter and the physical activity-indicative parameter performed by the controller, and controlling the one or more pulse generators to pace at a rate greater than the resting rate in response to detection of a sleeping condition and a further increased rate in response to detection of a sleep apnea condition.

16. (Original) An implantable cardiac stimulation device according to Claim 12 further comprising:

a transthoracic impedance sensor that is capable of sensing a respiration parameter and functioning as the metabolic demand sensor; and

an accelerometer or piezoelectric crystal sensor that is capable of sensing a physical activity parameter and functioning as the activity sensor.

## PATENT

17. (Currently Amended) A method of operating an implantable cardiac stimulation device comprising:

generating cardiac pacing pulses at a predetermined rate;

sensing a parameter indicative of a body's metabolic demand;

sensing a parameter indicative of physical activity of the body;

analyzing a plurality of sensed metabolic demand parameters and a plurality of sensed physical activity parameters to determine if a ~~potential~~ sleep apnea condition exists; and

controlling the cardiac pacing pulses according to a sleep apnea prevention mode to terminate the detected ~~prevent~~ sleep apnea condition when a potential sleep apnea condition is detected; and

generating neurostimulation pulses for application to the body's upper airways or diaphragm to terminate the sleep apnea condition if the cardiac pacing pulses fail to terminate the sleep apnea condition.

18. (Original) A method according to Claim 17 further comprising:  
analyzing a sequence of sensed metabolic demand parameters in comparison with a sequence of sensed physical activity parameters to determine a sleep condition.

19. (Currently Amended) A method according to Claim 17 further comprising:  
analyzing a sequence of sensed metabolic demand parameters in comparison with a sequence of sensed physical activity parameters to determine ~~[[a]]~~ the sleep apnea condition.

20. (Original) A method according to Claim 17 further comprising:  
detecting a sleep condition upon a determination that the metabolic demand-indicative parameter and the physical activity-indicative parameter are at low resting levels.

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## PATENT

21. (Currently Amended) A method according to Claim 17 further comprising:

detecting ~~[[a]]~~ the sleep apnea condition upon a determination that the metabolic demand-indicative parameter diverges to a lower level relative to the physical activity-indicative parameter.

22. (Cancelled)

23. (Currently Amended) An implantable cardiac stimulation device comprising:

means for sensing a parameter indicative of the body's metabolic demand;

means for sensing a parameter indicative of physical activity of the body;

means for generating cardiac pacing pulses; and

means for ~~determining a potential~~ detecting a sleep apnea condition based on the respective means for sensing; and

means for controlling the means for generating according to a sleep apnea prevention mode when the ~~a-potential~~ sleep apnea condition is detected; and

means for generating neurostimulation pulses for application to the body's upper airways or diaphragm to terminate the sleep apnea condition if the generation of cardiac pulses fails to terminate the sleep apnea condition.

24. (Original) An implantable cardiac stimulation device according to Claim 23 further comprising:

means for detecting a sleep condition upon a determination that the metabolic demand-indicative parameter and the physical activity-indicative parameter are at low resting levels.

## PATENT

25. (Currently Amended) An implantable cardiac stimulation device according to Claim 23 further comprising:

means for detecting [[a]] the sleep apnea condition upon a determination that the metabolic demand-indicative parameter diverges to a lower level relative to the physical activity-indicative parameter.

26. (Cancelled)